

ECHINODERMS FROM THE NORTHERN REGION OF THE GREAT BARRIER REEF, AUSTRALIA

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SYNOPSIS

This paper gives records of about 140 species of echinoderms from the northern region of the Great Barrier Reef collected during the Royal Society–Universities of Queensland Expedition in 1973. One ophiuroid species is new to science, namely *Amphiura phrixocantha* sp. nov. (p. 121). Ten other ophiuroids, two echinoids and one holothurian are new to the Australian fauna and the ranges of eight more ophiuroids and one holothurian are extended to the Great Barrier Reef Province from other parts of Australia. In addition, a few unpublished records from relevant material in the British Museum collections are included and notes are given on several species of especial interest. In contrast to most shallow-water tropical collections, the one from this Expedition includes a high proportion of burrowing species from soft substrates. A list of some animal associates of the specimens collected is appended.

INTRODUCTION

EARLY investigations of the echinoderm fauna of the Great Barrier Reef were largely centred on the Torres Strait region and essentially began with the visit of the *Challenger* Expedition in 1874. The material collected, mostly from dredging, together with that taken by the *Alert* Expedition in 1881, provided records for a basic list of about 80 species. Subsequently, two land-based expeditions, firstly that of R. Semon in 1892 and later that of the Carnegie Institution of Washington in 1913, increased the number of species known in the area to about 250 (H. L. Clark, 1915, 1921).

South of Torres Strait along the east coast of Queensland early records of echinoderms were provided by the observations and collections of Tenison-Woods (1880a, b) made in the Port Douglas–Trinity Bay area and by the *Alert* Expedition, collecting particularly from Port Curtis, Port Molle and Port Denison (see Bell, 1884). The next substantial collection was not made until 1924 when W. E. J. Paradise took about 60 species, chiefly between the latitudes of 17° and 19°S (H. L. Clark, 1926; McNeill & Livingstone, 1926). This collection also included specimens from Low Isles (16°23'S), the echinoderm fauna of which is now well known as a result of the surveys by the Great Barrier Reef Expedition in 1928–29 (H. L. Clark, 1932; Livingstone, 1932) and the Great Barrier Reef Committee in 1954 (Endean, 1956). In recent years, further echinoderm records (excluding crinoids) have been compiled by Endean (1953, 1961, 1965), while crinoids from the Swain Reefs Expedition of 1962 have been dealt with by A. M. Clark (1975).

The Great Barrier Reef as a zoogeographical region has been discussed in detail by such authors as Whitley (1932), H. L. Clark (1946) and Endean, Kenny & Stephenson (1956). In the present paper, the Great Barrier Reef Province is taken

to include the sea area east of longitude 142°E (just west of Torres Strait) down to a depth of 200 m, from Anchor and Bramble Cays (between $9^{\circ}00'\text{S}$ and $9^{\circ}20'\text{S}$) in the north to Fraser Island including Hervey Bay (effectively the latitude of 25°S) in the south. Echinoderm records from the Queensland coast are summarized by H. L. Clark (1946) and, except for crinoids, by Endean (1957) with later additions also by Endean (1961, 1965). Within the geographical limits defined above it appears that about 310 species of echinoderms have been recorded from shallow-water; however, many of these species are known from relatively few localities and/or specimens and records are particularly sparse for the northern part of the Great Barrier Reef outside the Torres Strait region. Accordingly a list of the echinoderms collected in this area during the 1973 expedition should be of some zoogeographic value, especially as very little systematic dredging or trawling has previously been undertaken in the region as a whole (Dall & Stephenson, 1953).

The echinoderm records given in the present paper result from the material collected during the Royal Society-Universities of Queensland Expedition to the Great Barrier Reef which took place from July to November 1973. The investigations of Phases I and II of the Expedition were mostly concerned with the structure and ecology of islands and reefs between Cairns and Pipon Island (approximately 17°S to 14°S) but Phase III operations extended northwards to Raine Island ($11^{\circ}36'\text{S}$).

Most of the records given below, particularly those of ophiuroids, originate from a benthic survey carried out using naturalist and anchor dredges (Forster, 1953) and involving bottom sampling at 62 stations in depths of 4-64 m between the latitudes of $16^{\circ}42'\text{S}$ to $11^{\circ}40'\text{S}$. Station data are given in Table 1.

TABLE 1

The positions of the stations at which dredge samples were taken in the northern part of the Great Barrier Reef, with depth, description of deposit and date of collection also given

| STATION | LATITUDE (S) | LONGITUDE (E) | DEPTH (m) | DEPOSIT | DATE (1973) |
|---------|--------------------|---------------------|--------------|-------------------------------|----------------|
| D1 | $14^{\circ}25'2''$ | $144^{\circ}47'9''$ | 15 | Muddy sand with many forams | 5 Aug. |
| D2 | $14^{\circ}25'1''$ | $144^{\circ}48'6''$ | 15 | Muddy sand with many forams | 5 Aug. |
| D3 | $14^{\circ}24'9''$ | $144^{\circ}50'1''$ | 16 | Muddy sand with many forams | 6 Aug. |
| D4 | $14^{\circ}27'1''$ | $144^{\circ}53'8''$ | 20 | Muddy sand with many forams | 6 Aug. |
| D5 | $14^{\circ}28'7''$ | $144^{\circ}55'7''$ | 18 | Muddy sand with many forams | 6 Aug. |
| D6 | $14^{\circ}29'2''$ | $144^{\circ}57'8''$ | 26 | Muddy sand with many forams | 6 Aug. |
| D7 | $14^{\circ}28'8''$ | $145^{\circ}0'2''$ | 26 | Muddy sand with many forams | 7 Aug. |
| D8 | $14^{\circ}28'0''$ | $145^{\circ}0'0''$ | 26 | Muddy sand with many forams | 7 Aug. |
| D9 | $14^{\circ}26'7''$ | $144^{\circ}58'9''$ | 37 | Shell gravel | 7 Aug. |
| D10 | $14^{\circ}29'2''$ | $144^{\circ}57'1''$ | 20 | Shell gravel | 7 Aug. |
| D11 | $14^{\circ}21'1''$ | $144^{\circ}53'6''$ | 22 | Muddy sand with many forams | 8 Aug. |
| D12 | $14^{\circ}17'9''$ | $144^{\circ}53'4''$ | 24 | Muddy sand with shells | 8 Aug. |
| D13 | $14^{\circ}14'8''$ | $144^{\circ}53'2''$ | 22 | Shell gravel | 8 Aug. |
| D14 | $14^{\circ}15'8''$ | $144^{\circ}51'1''$ | 33 | Muddy fine sand with shells | 8 Aug. |
| D15 | $14^{\circ}22'6''$ | $144^{\circ}50'2''$ | 16 | Muddy sand with forams | 8 Aug. |
| D16 | $14^{\circ}32'2''$ | $144^{\circ}53'4''$ | 11 | Muddy sand with shells | 9 Aug. |
| D17 | $14^{\circ}34'2''$ | $144^{\circ}52'2''$ | 4 | Clean medium sand with shells | 9 Aug. |

TABLE I (cont.)

| STATION | LATITUDE (S) | LONGITUDE (E) | DEPTH (m) | DEPOSIT | DATE (1973) |
|---------|-----------------|------------------|--------------|---|----------------|
| D18 | 14°34'0" | 144°50'5" | 4 | Clean coarse sand with calcareous algae | 9 Aug. |
| D19 | 14°31'8" | 144°50'7" | 9 | Muddy sand with shells | 9 Aug. |
| D20 | 16°40'4" | 145°57'8" | 22 | Silty mud with many forams | 16 Aug. |
| D21 | 16°40'4" | 145°59'1" | 24 | Silty mud with many forams | 16 Aug. |
| D22 | 16°40'3" | 146°0'2" | 27 | Calcareous mud with few forams | 16 Aug. |
| D23 | 16°39'2" | 146°1'2" | 27 | Muddy sand with many forams | 17 Aug. |
| D24 | 16°40'1" | 146°1'2" | 29 | Calcareous mud with many bivalves | 17 Aug. |
| D25 | 16°40'7" | 146°1'0" | 27 | Calcareous mud with many bivalves | 17 Aug. |
| D26 | 16°41'1" | 146°0'8" | 22 | Muddy sand with many forams | 17 Aug. |
| D27 | 16°38'1" | 145°57'8" | 27 | Silty mud with many forams | 18 Aug. |
| D28 | 16°39'2" | 145°57'6" | 27 | Silty mud with many forams | 18 Aug. |
| D29 | 16°41'6" | 145°57'3" | 9 | Clean medium sand | 18 Aug. |
| D30 | 15°44'3" | 145°27'8" | 11 | Muddy fine sand | 31 Aug. |
| D31 | 15°44'3" | 145°27'7" | 11 | Muddy fine sand | 31 Aug. |
| D32 | 15°44'0" | 145°27'1" | 18 | Muddy fine sand with forams | 31 Aug. |
| D33 | 15°43'2" | 145°27'4" | 16 | Sandy silt - few forams | 31 Aug. |
| D34 | 15°43'8" | 145°29'2" | 27 | Mud with coral fragments | 1 Sept. |
| D35 | 15°44'4" | 145°31'1" | 27 | Mud | 1 Sept. |
| D36 | 15°45'0" | 145°33'0" | 37 | Mud with coral and shell | 1 Sept. |
| D37 | 15°45'6" | 145°35'0" | 29 | Calcareous mud | 1 Sept. |
| D38 | 15°42'9" | 145°25'6" | 21 | Muddy coarse sand with forams | 2 Sept. |
| D39 | 15°40'9" | 145°22'9" | 20 | Muddy sand with many shells | 2 Sept. |
| D40 | 15°39'3" | 145°22'0" | 18 | Muddy sand with much shell | 2 Sept. |
| D41 | 15°37'8" | 145°21'0" | 16 | Muddy sand with shells | 2 Sept. |
| D42 | 15°39'5" | 145°29'4" | 16 | Calcareous mud with coral | 4 Sept. |
| D43 | 15°39'0" | 145°28'8" | 18 | Calcareous mud with coral | 4 Sept. |
| D44 | 15°38'3" | 145°28'0" | 16 | Coral blocks | 4 Sept. |
| D45 | 15°37'3" | 145°26'5" | 22 | Muddy sand with many forams | 4 Sept. |
| D46 | 14°44'0" | 145°11'6" | 9 | Muddy sand with few forams | 1 Oct. |
| D47 | 14°43'7" | 145°12'1" | 9 | Muddy sand with few forams | 1 Oct. |
| D48 | 14°43'4" | 145°11'0" | 7 | Muddy sand with few forams | 1 Oct. |
| D49 | 14°42'6" | 145°10'1" | 7 | Muddy sand with few forams | 1 Oct. |
| D50 | 14°36'8" | 145°28'7" | 22 | <i>Halimeda</i> sand | 21 Oct. |
| D51 | 14°37'2" | 145°26'3" | 22 | Silty sand with forams | 21 Oct. |
| D52 | 14°39'3" | 145°25'7" | 24 | Silty sand with forams | 21 Oct. |
| K1(A) | 13°28'2" | 143°42'0" | 22 | Sticky black mud | 28 Oct. |
| K2(A) | 13°12'2" | 143°34'1" | 11 | Sticky black mud | 29 Oct. |
| K3(A) | 11°50'0" | 143°34'2" | 64 | Silty fine sand with shells | 31 Oct. |
| K3(N) | " | " | " | " | 5 Nov. |
| K4(A) | 11°40'4" | 143°57'8" | 35 | <i>Halimeda</i> sand | 3 Nov. |
| K5(A) | 11°40'4" | 143°58'5" | 34 | Silty sand with <i>Halimeda</i> | 3 Nov. |
| K6(A) | 11°40'4" | 143°59'3" | 36 | <i>Halimeda</i> sand | 3 Nov. |
| K7(N) | 11°40'2" | 144°0'2" | 22 | Medium-coarse sand | 3 Nov. |
| K8(N) | 11°48'4" | 143°21'4" | 18 | Silty sand with forams | 6 Nov. |
| K9(N) | 12°9'0" | 143°13'2" | 24 | Black mud with shells | 7 Nov. |
| K10(N) | 12°18'0" | 143°19'6" | 34 | Black mud with shells | 8 Nov. |

Stations D1-D52 were sampled with a naturalist dredge, Stations K1-K10 with anchor (A) and/or naturalist (N) dredge.

TABLE 2

Positions of islands and reefs where collections of littoral echinoderms were made.
Dates of collection and survey station numbers are given

| LOCALITY | LATITUDE (S) | LONGITUDE (E) | DATE | SURVEY STATIONS |
|--------------------------------|--------------|---------------|----------------|--------------------|
| Beesley | 12°14.5' | 143°12.0' | 7 Nov. | |
| Bewick | 14°26.0' | 144°48.6' | 9 Aug. | |
| Bird | 11°45.4' | 143°05.2' | 6 Nov | |
| Hampton | 14°33.8' | 144°53.2' | 11 Aug | |
| Howick | 14°30.2' | 144°58.4' | 8 Aug | |
| Ingram | 14°30.0' | 144°52.8' | 22/23 Oct | IN.1-IN.3 Z4-Z5 |
| Lark Passage (reef to N of) | 15°06.0' | 145°44.0' | 25 Sept | |
| Lizard | 14°40.0' | 145°28.0' | 21 Oct | LD/Z3 |
| Low | 16°23.2' | 145°34.0' | 23/30 Aug | L1-L7 |
| Mid Reef | 14°27.5' | 144°57.5' | 10 Aug | |
| Noble | 14°30.4' | 144°46.0' | 23 Oct | |
| Pelican | 13°55.0' | 143°50.0' | 29 Oct | |
| Pipon | 14°07.4' | 144°31.5' | 25 Oct | |
| Three | 15°07.0' | 145°25.5' | 6/28 Sept | 3.1-3.11 Z1-Z2 |
| Turtle I | 14°44.0' | 145°11.3' | 29 Sept/14 Oct | TIA-TIC |
| Turtle IV | 14°43.2' | 145°12.2' | 8 Oct | |
| Two | 15°01.3' | 145°26.6' | 20/22 Sept | 2.1-2.4 |
| Watson | 14°28.0' | 144°53.5' | 28 July | |

TABLE 3

British Museum echinoderm collection : additional unpublished localities

| LOCALITY (REEF) | LATITUDE (S) | LONGITUDE (E) | DEPTH (m) |
|--------------------|--------------|---------------|--------------|
| Farquharson | 17°47.5' | 146°31.0' | 3-6 |
| Lodestone | 18°41.5' | 147°06.0' | |
| Sudbury | 17°00.0' | 146°13.0' | 3-6 |
| Wheeler | 18°48.5' | 147°31.5' | |

Littoral investigations were chiefly directed towards a survey of the fauna inhabiting the intertidal sand and mud flats on those islands and reefs visited by the Expedition. Stations are prefixed by the initial letter(s) of the island name (Table 2): details of this survey will be published elsewhere (Gibbs, 1976). In addition, collections of echinoderms were also made on reef flats; for the most part these species were living either under coral boulders or in crevices. Sublittoral crinoids were kindly sampled by Mr L. Zell at five localities (designated Z stations), all at 3-5 m depth, as follows:

- Z1 - Three Isles - north end, off sand cay, September 23.
- Z2 - Three Isles - south-east, off mangrove island, September 26.
- Z3 - Lizard Island - off north-east promontory, October 21.
- Z4 - Ingram Island - south-west of sand cay, October 22.
- Z5 - Ingram Island - north-west of sand cay, October 23.



Map showing collecting localities

The Expedition collection is composed of about 450 specimens consisting of about 140 species plus about 12 samples of immature or incomplete specimens not positively identifiable to species. About two-thirds of the species are represented by only one or two specimens but this need not imply rarity in many cases since the larger littoral forms for example, particularly the species of holothurians, were purposely collected only once or twice, although generally common and widespread. The class Crinoidea is represented by 15 species, Asteroidea by 17, Ophiuroidea by 56,

Echinoidea by 21 and Holothurioidea by 29 species. Of these totals it would appear that 11 ophiuroids (including 1 new species), 2 echinoids and 2 holothurians* are recorded for the first time from Australian waters and 8 further ophiuroids and 1 holothurian newly from the Great Barrier Reef Province. These species are indicated in the systematic account. Twenty-two of the species are not listed by A. M. Clark & Rowe (1971) as occurring in some part of the whole of northern Australia, so that the number of species from this area is increased to about 460; the total number of species for the Great Barrier Reef Province rises to about 330.

Considerable faunistic information is available for Low Isles as a result of the surveys of 1928-29 and 1954. The 1973 expedition spent just seven days at Low Isles but it is worth noting that seven species of echinoderms, previously unrecorded for these islands, were taken. These are *Gomophia egyptiaca*, *Amphioplus* (*Lymanella*) *bocki*, *Amphiura diacritica*, *Schizaster lacunosus*, *Leptosynapta latipatina*, *Opheodesoma grisea* and *Chiridota rigida*.

The bulk of the echinoderm material collected on the Royal Society-Universities of Queensland Expedition has been deposited in the collections of the British Museum (Natural History). Selected specimens donated to the Australian Museum, Sydney, are indicated in the text by the numbers in square brackets []. The paratype of *Amphiura phrixocantha* sp. nov. only, is in the Queensland Museum.

This report was initiated by one of us (P. E. G.) who drew up the introduction, list of associated animals (see Table 4, p. 141) and record data for the species using identifications made by the others. The notes on individual species of crinoids are by A. M. C., those on echinoids and holothurians by C. M. C., the two combining on ophiuroids so that the new species is the responsibility of both Clarks.

SPECIES COLLECTED

For each species the locality or station and number of specimens are given, details being found in Tables 1 and 2. Sight records of distinctive species (not collected) are indicated by 'S'. In the case of those species for which few locality or specimen records from the Great Barrier Reef Province exist, these are cited together with any unpublished records from the British Museum collections (Table 3). The remaining species are considered to be widespread in the Province (see Endean, 1957) and a blanket distribution for them can be assumed. References are kept to a minimum by citing, wherever possible, H. L. Clark (1946), or an alternative reference from which the original description can be traced. Synonyms and other combinations used by H. L. Clark, Livingstone and Endean are included.

Class CRINOIDEA

COMASTERIDAE

Capillaster multiradiatus (Linnaeus, 1758)

See: H. L. Clark, 1946: 27.

D52 - 1; K3 - 1.

* One of these is the species here named '*Rynkatorpa* sp. nov.'. Since this paper went to press Dr Rowe has provided a specific name and description, to be published shortly in this Bulletin.

Comantheria briareus (Bell, 1882)

See : H. L. Clark, 1946 : 34.

Three Is (Z2) - 4[1].

Previous records : Port Denison ; Outer Reef between 17°S and 19°S (H. L. Clark, 1946).

***Comantheria* or *Comanthus* sp.**

D51 - 1.

This specimen is immature with only 18 very slender arms, *c.* 70 mm long, and few division series - hence the uncertainty as to genus. Three arms arise direct from the first (IBr) division series. The proximal ossicles are smooth. The centrodorsal is very reduced, in the form of a flat pentagon marked by subradial clefts. It bears a single cirrus socket and four small 'buds' of cirri. One IIIBr series is present ; this has four ossicles (like all seven IIBr series) and is an outer one. On this account the specimen is more like *Comanthus parvicirrus timorensis* than *Comantheria briareus*, which usually has only two ossicles in the IIIBr series.

Comanthina schlegeli (P. H. Carpenter, 1881)

See : H. L. Clark, 1946 : 33.

Three Is (Z2) - 1 ; Lizard I. (Z3) - 1.

Previous records : Murray Is (3 specimens) ; Percy Is (1 specimen), (H. L. Clark, 1946).

Comanthus bennetti (J. Müller, 1841)

See : H. L. Clark, 1946 : 36 (as *Cenolia bennetti*) ; A. M. Clark & Rowe, 1971 : 16 (as *Comanthus bennetti*).

Lizard I. (Z3) - 1.

B.M. collections : Wheeler Reef, near Townsville (3 specimens).

Previous records : Port Denison ; north of N Direction I. (2 specimens) (H. L. Clark, 1946).

Comanthus parvicirrus (J. Müller, 1841)

See : H. L. Clark, 1946 : 39 ; A. M. Clark, 1975 : 395.

SYNONYMS : *Comanthus annulata* (Bell, 1882) H. L. Clark, 1921 ; *Comanthus callipepla* H. L. Clark, 1915 ; *Comanthus timorensis* (J. Müller, 1841) H. L. Clark, 1946.

Howick I. (north side at 3 metres depth) - [1] ; Three Is (Z1) - 2 ; Ingram I. (Z5) - 2 ; Lark Passage (reef flat) - 2.

Comanthus samoanus A. H. Clark, 1909

See : H. L. Clark, 1946 : 36 (as *Cenolia samoana*) ; A. M. Clark & Rowe, 1971 : 16 (as *Comanthus samoanus*).

Ingram I. (Z4) - 1 ; (Z5) - 2 ; Lark Passage (reef flat) - 1.

Comatella nigra (P. H. Carpenter, 1888)

See : H. L. Clark, 1946 : 25 ; A. M. Clark, 1975 : 392.

D52 - 1.

B.M. collections : Wheeler Reef, near Townsville (2 specimens).

Previous records : Murray Is ; Lizard I. (H. L. Clark, 1946) ; Swain Reefs (A. M. Clark, 1975).

This specimen does not help to solve the problem of the distinction between *Comatella nigra* and *Comatella stelligera* mentioned by A. M. Clark (1975). It has only 28 arms, so running down to *C. stelligera*, but the arm length is only c. 55 mm so the infrequency of them could be accountable to immaturity. One of the few mature cirri remaining has as many as 26 segments, the division series are well separated laterally and smooth and the arms feel smooth when stroked distalwards, since only fine grooving develops on the middle and distal brachials, all characters justifying its identification as *C. nigra*.

However, seven specimens of *Comatella* from the Easter Group, Abrolhos Islands, Western Australia (collected by a recent Aquinas College expedition) do fall easily into two distinct groups. Three of them have c. 54, 59 and c. 60 arms, smooth to the touch, and up to c. 31, 31 (or ? 32) and 35 cirrus segments (cirrals) - agreeing with *C. nigra* - as opposed to 28, 29, 29 and 29 arms, rough in texture, and up to only 21, 22, 23 and 23 cirrals respectively in the remaining four specimens, which are referable to *C. stelligera*. The arm length is 75-90 mm in the former (*nigra*) and 90-110 mm in the latter, giving no significant size difference.

The cirri are remarkably reduced in this Queensland specimen, only VII mature ones remaining besides about ix more or less reduced immature ones and about six obsolete cirrus sockets. The number is usually XX-XXX.

Comatella stelligera (P. H. Carpenter, 1880)

See : H. L. Clark, 1946 : 26.

Three Is. (Z1) - 1.

This specimen has 29 fairly crowded arms, with little space between the division series laterally and up to only 23 cirrus segments, agreeing with *C. stelligera*.

Comatula pectinata (Linnaeus, 1758)

See : H. L. Clark, 1946 : 31 ; A. M. Clark, 1975 : 394.

K3 - 1.

Comatula purpurea (J. Müller, 1843)

See : A. M. Clark, 1975 : 394.

D8 - 1.

Comatula rotalaria Lamarck, 1816

See : H. L. Clark, 1946 : 29 (as *Validia rotalaria*) ; A. M. Clark, 1975 : 393 (as *Comatula (Validia) rotalaria*).

D7 - 1.

HIMEROMETRIDAE***Himerometra robustipinna*** (P. H. Carpenter, 1881)

See : H. L. Clark, 1946 : 42.

Bewick I. (7 m depth) - 2 ; Three Is (Z2) - 1 ; Lizard I. (Z3) - 3.

B.M. collections : Farquharson Reef (4 specimens) ; Sudbury Reef (1 specimen).

Previous records : Ellison Reef (2 specimens) (H. L. Clark, 1946).

One of the three specimens from Lizard Island is aberrant in three characters. Firstly, its enlarged basal pinnules are almost smooth in profile, the segments not being individually flared at their distal ends, while they number from 26 to as many as 32 on the few that are still intact. In *H. robustipinna* the maximum number given by A. H. Clark is 24 segments. Secondly, of the up to 39 segments of the peripheral cirri, as many as 20 of the distal ones have a fairly well-developed blunt, nose-like dorsal spine. In *H. robustipinna* usually less than ten distal segments are described as having a small median tubercle and sometimes this may be negligible. Thirdly, the middle brachials are more markedly flared and more rugose at their distal ends than in the remaining specimens, though A. H. Clark and others appear to give little weight to this character, which is hardly mentioned in the published descriptions of the species of *Himerometra*.

This aberrant specimen seems to approximate to *Himerometra bartschi* A. H. Clark, 1908, known from Singapore to the Kei Islands, in the relatively large number of segments in the proximal pinnules (though as many as 40 are described for *H. bartschi*) which are also fairly smooth, and in the greater development of dorsal spines on the distal cirrus segments (about 25 segments being spinose in *H. bartschi*, described as 'small but prominent'). However, A. H. Clark considers *H. robustipinna* to be a particularly variable species and in the holotype itself the proximal pinnules are relatively smooth. The difference in the cirri may be more significant but better sampling is needed to show whether or not a second species of *Himerometra* can be recognized from Australian waters.*

* Since completion of this paper, another specimen from Lizard Island (North Reef, 18 m, collected by Neville Coleman) has come to hand. This too has relatively smooth basal pinnules, stout basally but slender and flagellate terminally, P_D having up to 27 segments. Two intact mature cirri with 31 and 34 segments have dorsal spines from about the twelfth. Both these characters agree with the aberrant specimen but the brachials, though becoming slightly flared, are not rugose.

COLOBOMETRIDAE

Colobometra perspinosa (P. H. Carpenter, 1881)

See : H. L. Clark, 1946 : 52.

Lizard I. (Z₃) - 1.

Oligometra carpenteri (Bell, 1884)

See : H. L. Clark, 1946 : 49.

D21 - 1.

TROPIOMETRIDAE

Tropiometra afra (Hartlaub, 1890)

See : H. L. Clark, 1946 : 53.

Ingram I. (Z₄) - 6 ; (Z₅) - 1.

B.M. collections : Lodestone Reef, NE of Townsville (1 specimen) ; Wheeler Reef, near Townsville (2 specimens).

Previous records : Murray Is (3 specimens) ; Bowen (2 specimens) (H. L. Clark, 1946).

Subclass ASTEROIDEA

ASTROPECTINIDAE

Astropecten granulatus Müller & Troschel, 1842

See : H. L. Clark, 1946 : 76.

K9 - 1.

ARCHASTERIDAE

Archaster typicus Müller & Troschel, 1840

See : H. L. Clark, 1946 : 79.

Hampton I. (reef flat) - 3[2] ; Low Is (L₄) - 3 ; Three Is (L₅) - S.

GONIASTERIDAE

Stellaster equestris (Retzius, 1805)

See : H. L. Clark, 1946 : 97 (as *Stellaster incei*) ; A. M. Clark & Rowe, 1971 : 49 (as *Stellaster equestris*).

D19 - 1.

Stellaster sp. juv. aff. *S. equestris* (Retzius)

K6 - 1 ; K9 - 1.

OREASTERIDAE

Culcita novaeguineae Müller & Troschel, 1842

See : H. L. Clark, 1946 : 108.

Low Is. - S ; Three Is - S.

Pentaceraster regulus (Müller & Troschel, 1842)

See : H. L. Clark, 1946 : 107 (as *P. australis*) ; Endean, 1953 : 54 (as *P. australis*) ;

A. M. Clark & Rowe, 1971 : 55 (as *P. regulus*).

D17 - 2 ; D18 - 1.

Protoreaster nodosus (Linnaeus, 1758)

See : H. L. Clark, 1946 : 106.

D18 - 4.

OPHIDIASTERIDAE

Fromia sp. juv.

Lizard I. (Z3) - 1 (on crinoid *Comanthus bennetti*).

Gomophia egyptiaca Gray, 1840

See : Endean, 1965 : 230.

Low Is (off NE shore at 3 m depth) - 1.

Previous record : Heron I. (2 specimens), (Endean, 1965).

Linckia laevigata (Linnaeus, 1758)

See : H. L. Clark, 1946 : 117.

Mid Reef - S ; Three Is - S ; Lark Passage - S.

Nardoa mamillifera Livingstone, 1930

See : H. L. Clark, 1946 : 116.

D44 - 1.

Previous record : Murray Is (Livingstone, 1930).

Nardoa pauciforis (von Martens, 1866)

See : H. L. Clark, 1946 : 115.

Mid Reef - S ; Three Is - S.

Ophidiaster granifer Lütken, 1872

See : H. L. Clark, 1946 : 121.

Turtle IV I. (reef flat) - 2.

METRODIRIDAE

Metrodira subulata Gray, 1840

D48 - 1 (juvenile identified by Mrs Loiset M. Marsh).

ASTEROPSEIDAE

Asteropsis carinifera (Lamarck, 1816)

See : H. L. Clark, 1946 : 109 (as *Asterope carinifera*) ; Endean, 1956 : 124 (as *Asterope carinifera*) ; A. M. Clark & Rowe, 1971 : 65 (as *Asteropsis carinifera*).
Low Is (*Tripneustes* spit) - 1 ; Lark Passage (reef flat) - 1.

ASTERINIDAE

Nepanthia brevis (Perrier, 1875)

See : H. L. Clark, 1946 : 141.

North of Snake Reef at 14°26.2'S : 145°0.7'E (Grab st. 115), 24 m depth, mud - 1.

Patiriella pseudoexigua Dartnall, 1971

See : H. L. Clark, 1946 : 136 (as *Patiriella exigua* [part]) ; Endean, 1953 : 54 (as *Patiriella exigua*) ; 1956 : 125 (as *Patiriella exigua*) ; Dartnall, 1971 : 43 (as *Patiriella pseudoexigua*). [Non *Asterias exigua* Lamarck, 1816.]

Three Is (3.7) - [1] ; Turtle I I. (TIC) - 3.

ACANTHASTERIDAE

Acanthaster planci (Linnaeus, 1758)

See : H. L. Clark, 1946 : 150.

Ingram I. (Z4, Z5) - S.

Subclass OPHIUROIDEA

EURYALIDAE

Euryale aspera Lamarck, 1816

See : H. L. Clark, 1946 : 172.

K3 - 2.

OPHIOMYXIDAE

Ophiomyxa australis Lütken, 1869

See : H. L. Clark, 1946 : 170.

K6 - 1.

OPHIACANTHIDAE

Ophiacantha ?confusa Koehler, 1905

See : H. L. Clark, 1946 : 184.

K₃ - 1.

AMPHIURIDAE

The disc of many burrowing amphiurids is very vulnerable to loss during collection and accordingly several of these specimens cannot be determined as to species.

Amphiodia sp. juv.

D₂ - 1 ; D₂₁ - 2.

Amphioplus (Amphioplus) didymus H. L. Clark, 1938 (Fig. 1a)

See : H. L. Clark, 1946 : 206 ; A. M. Clark & Rowe, 1971 : 101, fig. 48d, e.

D₁ - 1 ; D₃ - 1 ; D₁₅ - 1 (no disc).

These specimens provide a new record for the Great Barrier Reef Province. The holotype was taken at Broome, NW Australia, and a paratype at Darwin, the type-locality of the very similar *Amphioplus stenaspis* H. L. Clark. H. L. Clark's descriptions and figures of these two species (1938) indicate that they can be distinguished by the contiguity of the radial and adoral shields and the arrangement of the oral papillae. However, his description contradicts his figure of *A. didymus* with regard to the adoral shields, which are in fact broadly contiguous in the holotype, as in *A. stenaspis*, while the present material from Queensland indicates that the radial shields may also be contiguous distally in *A. stenaspis*. (Incidentally the second point throws further doubt on the validity of *Amphioplus iuxtus* Murakami, 1943 from the Caroline Islands as distinct from *A. stenaspis*, commented on by A. M. Clark in 1971.) The character of the arrangement of the oral papillae in a concave row (in *A. didymus*) as opposed to a straight line concealing more of the oral tentacle scale (in *A. stenaspis*) used in the 1971 key to distinguish the two, is also now found to be variable. This leaves only the distinctive bihamulate shape of the second from lowest arm spine beyond the arm base in *A. didymus* as a reliable diagnostic character ; this spine in *A. stenaspis* is simply blunt distally (Fig. 1b).

Amphioplus didymus is also liable to be confused with *Amphioplus (Lymanella) bocki* Koehler (see below) which similarly has two very large tentacle scales and the second arm spine modified - though in the case of *A. bocki* no more than broad spatulate in the Queensland specimens. The most obvious distinctions are that *A. bocki* has only three arm spines proximally, the arms themselves are relatively longer (about 12 times the disc diameter), the radial shields are relatively broader and more fully contiguous and the dorsal arm plates are elliptical rather than blunted rectangular in shape.

***Amphioplus (Amphioplus) impressus* (Ljungman, 1867)**

See : A. M. Clark, 1970 : 63, fig. 91, m.

D22 - 2 ; D36 - 1 ; D40 - [1].

This is a new record for Australian waters. The species was previously known from various localities in the East Indies, including Timor and New Guinea approximating to Australia, from the Philippines and from Marovo lagoon, Solomon Islands, collected by Gibbs in 1965 (unpublished).

Amphioplus impressus may be confused with the following species, *Amphioplus intermedius*, since both are unusual among species of *Amphioplus* s.s. in having the distalmost oral papilla markedly broadened. Also the disc is fully scaled, often with a sharp edge, the radial shields are more or less fully contiguous, the arm spines number three and the two tentacle scales are moderate in size. The most obvious difference is that *A. impressus* has coarser, very well-defined disc scales (a minimum of six across the shortest line between two radial shields interradi ally in a specimen with d.d. 4.5 mm compared with *c.* 10 in *A. intermedius* with d.d. 2.5 mm). The rosette is also conspicuous in specimens of *impressus* with original (as opposed to regenerated) discs, the dorsal arm plates of that species also have a median distal angle and the first ventral arm plate is completely superficial, fitting up against the distal edges of the two outermost oral papillae rather than being overlain by them proximally.

***Amphioplus (Amphioplus) intermedius* (Koehler, 1905)**

See : A. M. Clark, 1970 : 45, 64.

D2 - 1.

This too is a new record for Australian waters. The species was previously known from the East Indies off Java and the Borneo Bank. Comparative remarks with *A. impressus* are given above.

***Amphioplus* sp. aff. *A. intermedius* (Koehler)**

D39 - 2(no discs).

***Amphioplus (Amphioplus) lucidus* Koehler, 1922**

See : H. L. Clark, 1946 : 204.

D8 - 1 ; D41 - 1 ; K3 - 1.

A new record for the Great Barrier Reef Province. The species was previously known to the west from Broome, NW Australia, and to the south-east from Broken Bay, N.S.W.

***Amphioplus (Amphioplus) stenaspis* H. L. Clark, 1938 (Fig. 1b, c)**

See : H. L. Clark, 1946 : 206 ; A. M. Clark & Rowe, 1971 : 101, fig. 53c-e.

D38 - 1(no disc) ; K6 - 1.

A new record for the Great Barrier Reef Province. The species was previously known only from Darwin.

Comparative remarks with *A. didymus* are given under that heading.

***Amphioplus (Lymanella) bocki* Koehler, 1910 (Fig. 1d-f)**

See : Devaney, 1974 : 106.

Low Is : (L5) - 1 ; (L6) - [1] ; (L7) - 1 ; Three Is (3.2) - 3.

These records provide an extension of range to Australian waters for this species, recently revived by Devaney from the synonymy of *Amphioplus (Lymanella) laevis* (Lyman). The species was previously known from Fiji, the Society Islands, the Tuamotu Archipelago and the Cook Islands, as well as from Marovo lagoon, Solomon Islands, collected by Gibbs in 1965 (unpublished).

A specimen from Three Isles has d.d. 5.5 mm and a.l. c. 70 mm, a ratio of c. 1 : 12. After about a year in alcohol some of the arm spines are still banded with brown and there is a brown spot in the centre of each oral shield ; otherwise the specimen is pale.

The disc scaling is rather fine with no distinct rosette ; the margin is distinctly angular. The radial shields are fully contiguous, length : breadth c. 3 : 1 and the length is about two-fifths of the disc radius, that is slightly smaller than shown in Koehler's photograph of 1927, but conforming with the range in Devaney's material.

The oral shields are spearhead-shaped, longer than broad, with a short distal lobe and a sharp proximal angle.

The dorsal arm plates are broad elliptical, the distal side straight to convex with no trace of a median angle (Fig. 1e). The ventral arm plates are pentagonal with the distal side straight. The arm spines number three throughout ; beyond the arm base the second one becomes flattened with the tip abruptly truncated. The two tentacle scales are very large, the one on the ventral arm plate sometimes extending distally beyond the plate.

The complete absence of any sort of median distal angle to the dorsal arm plates and the bluntness of the middle arm spine fully justify Devaney's restoration of *A. bocki* from the synonymy of *A. laevis*, provisionally recorded here from Australian waters, which has conspicuously slender, sharp pointed arm spines. There is clearly some variation in the degree of modification of the second arm spine in *A. bocki*. Koehler describes the spines as obtuse and rounded at the tips, the middle one being evidently not distinguished ; Devaney's from SE Polynesia are bluntly pointed, the middle spine widest, which description agrees with the two specimens from the Solomon Islands (Fig. 1f). The spatulate form of the middle spine in these Queensland specimens (Fig. 1d) therefore appears to be excessive but does not on its own justify a taxonomic distinction.

***Amphioplus (Lymanella) depressus* (Ljungman, 1867)**

See : H. L. Clark, 1946 : 205.

D1 - 1 ; D2 - 1 ; D6 - 1 ; D8 - 1 ; D19 - 1[1] ; K3 - 1 ; K8 - 2.

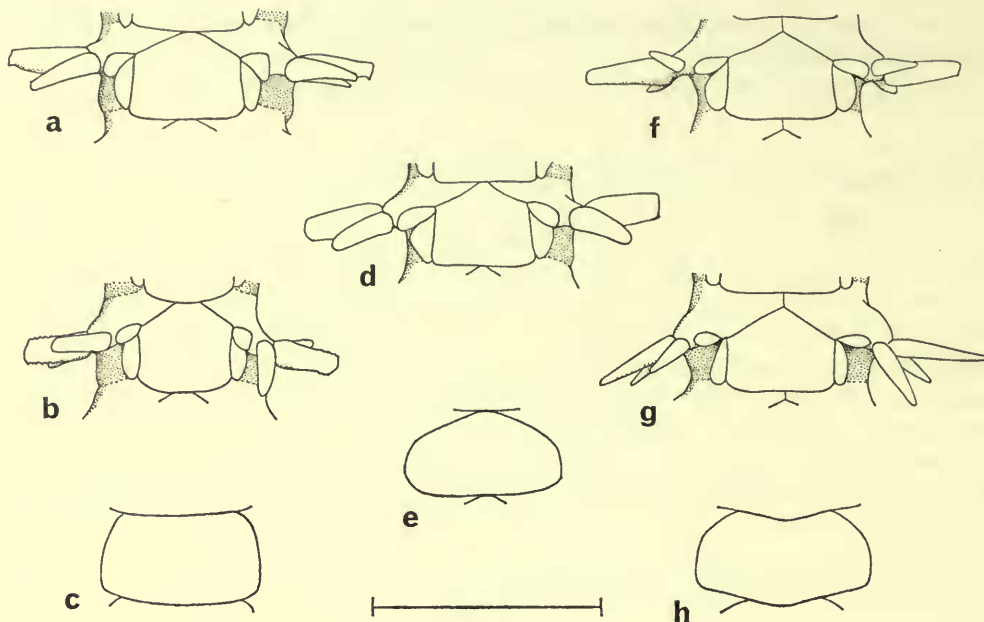


FIG. 1. Twentieth arm segments of *Amphioptus* species. (a) *Amphioptus* (*Amphioptus*) *didymus* H. L. Clark, d.d. c. 4 mm (actual disc lost), st. D15, ventral view. (b) and (c) *Amphioptus* (*Amphioptus*) *stenaspis* H. L. Clark, d.d. 3.8 mm, st. K6, ventral view (b) and the corresponding dorsal arm plate (c). (d) and (e) *Amphioptus* (*Lymanella*) *bocki* Koehler, d.d. 5.5 mm, Low Is, ventral view (d) and the corresponding dorsal arm plate (e). (f) *Amphioptus* (*Lymanella*) *bocki* Koehler, d.d. 6.0 mm, Marovo lagoon, Solomon Is, ventral view. (g) and (h) *Amphioptus* sp. ? *A. (Lymanella) laevis* (Lyman), d.d. c. 5 mm (actual disc lost), st. K2, ventral view (g) and the corresponding dorsal arm plate (h). [The scale represents 1 mm.]

These appear to be the first records of *Amphioptus depressus* from south of Torres Strait.

D.d. in the largest specimen seen by H. L. Clark from Australian waters is 6 mm. One of the present collection has the disc 1 mm broader.

***Amphioptus* sp. ? *A. (Lymanella) laevis* (Lyman, 1874) (Fig. 1g, h)**

See : A. M. Clark & Rowe, 1971 : 102, fig. 48b, c.

K2 - 2(no discs).

The slight median angle on the dorsal arm plates, relatively slender pointed arm spines and less exaggeratedly large tentacle scales than usual in *Lymanella* leave little doubt of the identity of these two specimens, but it should be confirmed by intact specimens with radial shields before the range of the species can definitely be extended to Australia. *A. laevis* was previously known from the Red Sea to the Philippines, the Gilbert Islands and various localities in the East Indies, besides also being taken at Marovo lagoon, Solomon Islands, with *Amphioptus (Lymanella) bocki* by Gibbs in 1965.

***Amphioplus* sp. aff. *A. (Amphioplus) pectinatus* Mortensen, 1933**

K10 - 1.

This small delicate specimen does retain the disc, though it is partly detached. The identification is only provisional on two counts, firstly because *Amphioplus pectinatus* is only known from as far away as Natal, South Africa, and secondly because there appear to be two distinct forms there, designated A and B by A. M. Clark (1974 : 456) and it is not yet certain to which one the holotype belongs.

D.d. in this specimen is c. 4.5 mm. The disc scaling is fairly fine, the radial shields are very long and narrow and barely contiguous distally, the oral shields are pear-shaped, the adorals only contiguous interradially on the jaw with the madreporic oral shield, the dorsal arm plates thin and broad fan-shaped, the arm spines slender and tapering, numbering four or five proximally for a few segments, then three, the second from lowest developing a small, distally directed hook and the tentacle scales numbering two, moderate in size. These characters conform with those of *A. pectinatus* but none of them are particularly distinctive, even in combination. However, the specimen also has two unusual features: there are spinose processes distal to each radial shield and there is a second oral tentacle scale on the side of the oral plate on the same level as the usual scale above (behind) the two middle oral papillae. The former occurs in both forms of *A. pectinatus* but the latter only in form B (A. M. Clark, 1974, fig. 8f-i).

***Amphipholis squamata* (Delle Chiaje, 1829)**

See : H. L. Clark, 1946 : 202.

D5 - 1 ; D6 - 1 ; D46 - 2 ; D47 - 1.

***Amphiura (Amphiura) ambigua* Koehler, 1905**

See : Koehler, 1905 : 39 ; H. L. Clark, 1946 : 196.

K10 - 1.

This is a new record for the Great Barrier Reef Province, though a specimen from Port Curtis in the British Museum collections is now also identified as *Amphiura ambigua*. The species was previously known in Australia from Darwin (H. L. Clark, 1938).

The K10 specimen has d.d. only 3 mm ; all the arms are badly broken. The distal oral papilla is small and peg-like, there are seven arm spines proximally, the lowest and uppermost spatulate, the second and third from lowest bihamulate and the others with only distally pointing hooks and there are two large tentacle scales. These characters agree with Koehler's description of the holotype of *A. ambigua*, from the Sulu Archipelago, Philippines, but not the ventral side of the disc which is naked, not scaled. However, in this it agrees with H. L. Clark's key, although he does not mention the anomaly elsewhere ; presumably his Darwin specimens are partly naked. In contrast, the Port Curtis specimen has fine scaling both dorsally

and ventrally ; d.d. is 6 mm and there are eight arm spines, the middle ones hooked ; the distal oral papilla is relatively larger and more rounded than in the smaller specimen.

Several species of amphiuroids are already known to show considerable variation in the extent of the disc scaling, notably *Amphiura acrystata* H. L. Clark, 1911, from the North Pacific, so this character alone is no barrier to considering ventrally naked Australian specimens to be conspecific with *A. ambigua*.

***Amphiura (Amphiura) bidentata* H. L. Clark, 1938**

See : H. L. Clark, 1946 : 197.

K3 - 2.

***Amphiura (Amphiura) catephes* H. L. Clark, 1938**

See : H. L. Clark, 1946 : 193.

D2 - 1 ; D6 - 1.

This is a new record for the Great Barrier Reef Province. The species was previously known only from two specimens taken at Port Jackson, N.S.W.

***Amphiura (Amphiura) constricta* Lyman, 1879**

See : H. L. Clark, 1946 : 194.

DI6 - 1 ; D46 - 1.

***Amphiura (Amphiura) diacritica* H. L. Clark, 1938**

See : H. L. Clark, 1946 : 196.

Low Is. (L6) - 1.

The holotype and only other recorded specimen was taken at Black Island, Whitsunday Group (H. L. Clark, 1938). The Low Isles specimen was found in muddy sand at low water mark.

***Amphiura leptotata* H. L. Clark, 1915**

See : A. M. Clark & Rowe, 1971 : 95, fig. 50a-c.

DI - 2 ; D2 - 3 ; DI1 - 2 ; DI6 - 2 ; D21 - [2] ; D23 - 3 ; D34 - 1 ; D39 - 1 ; D48 - 1 ; D49 - 1.

These records extend between 14°21'S and 16°40'S and provide an extension of range to Australia. The type-locality is in the Philippines and the species was also collected by Gibbs at Marovo lagoon, Solomon Islands, in 1965. It may have escaped attention because of the small size, d.d. in the holotype being only 3.5 mm and not exceeding 3 mm in the other specimens.

At d.d. 3 mm the arm length is 30+ mm. The disc is covered with very fine scales above but on the ventral side this gives way proximally to naked skin with

only scattered scales, appearing dark brown in colour. The radial shields are banana-shaped, two-fifths to half as long as the disc radius and with length : breadth *c.* 3 : 1 ; they are completely separated by a row of four or five scales.

The arm spines number four proximally, falling to three. The second spine from below is much broader than the others with an abruptly truncated tip, not simply tapering to a blunt tip. There are no tentacle scales.

The absence of tentacle scales distinguishes this species from all those included in H. L. Clark's key to the Australian species of *Amphiura*. However, with the partially bare underside of the disc it is shared by a species which H. L. Clark (1946 : 201) referred to *Ophionephthys*, namely *Ophiolepis perplexa* Stimpson, 1855, from Port Jackson, referred by Lyman in 1865 to *Amphiura*, to which it should be restored following A. M. Clark's restriction of *Ophionephthys* (1970). *Amphiura perplexa* does not appear to have been recorded from the Port Jackson area since 1855. If further material from N.S.W. proves to be conspecific with that from Queensland, then the name *Amphiura leptotata* must become a synonym.

***Amphiura (Amphiura) magnisquama* H. L. Clark, 1938**

See : H. L. Clark, 1946 : 195.

D17 - 1.

This is a new record for the Great Barrier Reef Province. The species was previously known from off Botany Bay, N.S.W. (H. L. Clark, 1938).

***Amphiura phrixocantha* sp. nov.**

(Fig. 2, Pl. 1, figs 1-3)

TYPE MATERIAL. D36 - 2. 15°45'S : 145°33'E (between Endeavour and Cairns Reefs, opposite Papuan Pass) at 37 m depth. Holotype B.M. reg. no. 1975.6.27.44 ; paratype Queensland Museum no G. 9297.

DESCRIPTION. The holotype has d.d. 8 mm, a.l. 30+ mm. The arms taper rather abruptly distally ; two of them are regenerating.

The disc is covered with relatively large, very thick scales, numbering five to seven across each interradius between adjacent radial shields. No primary rosette is distinguishable. The disc is strongly contracted interradially and on the ventral side and this probably accounts for the almost vertical alignment of the ventral scales. The radial shields are markedly convex abradially, 1.9-2.0 mm in length, with length : breadth *c.* 2.0 : 1 and length about half the disc radius. The two of each pair are completely separated by three (or in one case four) large scales.

The oral shields are keyhole-shaped, the main part almost circular but with a well-developed distal lobe ; length : breadth is 1.5 : 1. The adoral shields are broadly contiguous interradially with a rounded end radially ; from the middle half of the proximal side of each arises a relatively huge, very broad rounded distal oral papilla, about as long as the oral plate and about half again as broad, sometimes slightly prolonged interradially towards the block-like infradental papillae. The

first oral tentacle scale is compressed vertically and appears very narrow and pointed in ventral view. A most unusual additional scale borders the adradial side of the second (more superficial) oral tentacle pore like a vertical crest, its ventral end curling horizontally to a small extent just behind the large distal oral papilla, so giving the effect of a small conical additional oral papilla. It probably arises from the edge of the first ventral arm plate.

The dorsal arm plates are relatively narrow, covering only the midline of the arms, rounded octagonal in shape and broadly contiguous, the distal edge straight or slightly convex, about as broad as long proximally but becoming half as broad again by the twentieth segment. The ventral arm plates are broader than long, rectangular, with blunt distal corners, the proximal and distal sides straight.

The number of arm spines is nine proximally, falling to seven by the thirtieth segment but still as many as five on the distalmost segments remaining. Except for the three uppermost, which are simply flattened and blunt, and the lowermost one, which is pointed, all the spines are elaborately hooked, hence the specific name. The hooks are glassy and hyaline. The second from lowest spine is the longest and on the basal segments has a large hook directed proximally; beyond the disc it becomes bihamulate. The next three spines are mostly also bihamulate but the sixth usually has only the distal-pointing hook.

The tentacle scales are unusual. On the first four arm segments there are two large scales on each pore, a rounded proximal one on the lateral arm plate overlying a more elongated but truncated scale projecting at right angles from the side of the ventral arm plate. From about the fifth arm segment, the latter scale becomes gradually reduced in size and inset so as to become barely distinguishable from about the twelfth segment.

The paratype has d.d. c 5.5 mm. The disc is again very contracted interradially. The rosette is distinct among the large rounded scales. Proximally there are not

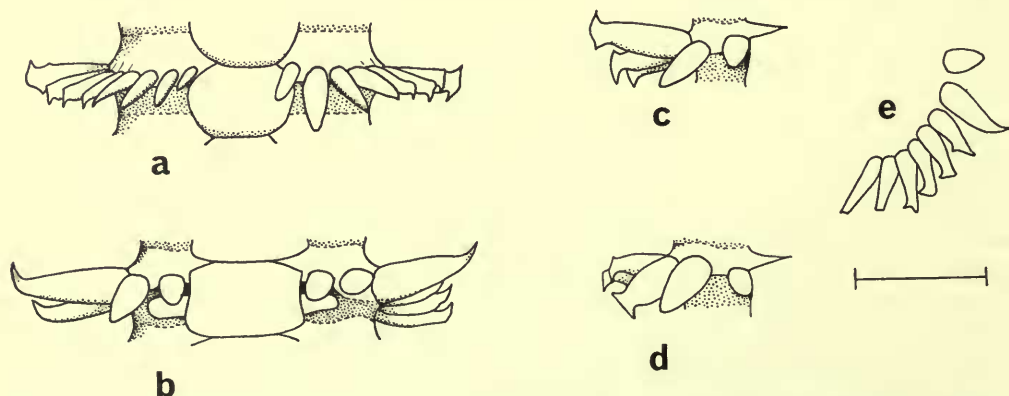


FIG. 2. *Amphiura phrixocantha* sp. nov. Holotype. (a) Twelfth arm segment in dorsal view. (b) Fifth segment in ventral view. (c) and (d) Parts of twelfth and twenty-fifth segments in ventral view. (e) Oblique distal ventrolateral view of seventh arm segment, the lower spines (shown uppermost in the figure) somewhat foreshortened. [The scale represents 1 mm.]

more than six arm spines. Otherwise it is similar to the holotype, allowing for the smaller size.

Both specimens, after about a year in alcohol, still show a yellow colour on the dorsal arm plates, interrupted at intervals by usually one to three unpigmented plates.

AFFINITIES. This species has most in common with *Amphiura dolia* H. L. Clark, 1938, from Port Jackson, to which it runs down in H. L. Clark's *Amphiura* key of 1946 (p. 191) since it has two tentacle scales, fully scaled disc with coarse scales and numerous arm spines. The very broad distal oral papilla is shared by both, while the disc scaling is also thick and the form of the radial shields similar in *A. dolia*, allowing for the much larger size of the holotype, d.d. 11–12 mm. However, the arm spines are still only up to eight in number at this large size and are unspecialized, 'pointed but not acute', also the second tentacle scale maintains its size, or even exceeds the proximal scale.

***Amphiura (Fellaria) octacantha* (H. L. Clark, 1915)**

See : H. L. Clark, 1946 : 200 (as *Ophionephthys octacantha*) ; A. M. Clark & Rowe, 1971 : 95, fig. 26b (as *Amphiura (Fellaria) octacantha*).

SYNONYM : *Ophionephthys decacantha* H. L. Clark, 1938.

K3 – 2.

Previous records : Torres Strait.

***Dougaloplus echinatus* (Ljungman, 1867)**

See : H. L. Clark, 1946 : 203 (as *Ophiocnida echinata*) ; A. M. Clark & Rowe, 1971 : 100 (as *Dougaloplus echinatus*).

D3 – 1 ; D23 – [1] ; D27 – 1.

Previous record : Papuan Pass (1 specimen) (H. L. Clark, 1932).

***Ophiocentrus verticillatus* (Döderlein, 1896)**

See : H. L. Clark, 1946 : 198.

D6 – 1.

A new record for the Great Barrier Reef Province. Previously the species was known from Broome, NW Australia.

OPHIACTIDAE

***Ophiactis savignyi* Müller & Troschel, 1842**

See : H. L. Clark, 1946 : 210.

Turtle I I. (reef flat) – 7.

***Ophiactis* sp. juv.**

D4 – 1 ; D6 – 2 ; D16 – 1.

OPHIOTRICHIDAE

Macrophiothrix belli (Döderlein, 1896)

See : H. L. Clark, 1946 : 221.

Mid Reef (reef flat) – 1 ; Turtle IV I. (reef flat) – 1.

Previous record : Torres Strait.

Macrophiothrix koehleri A. M. Clark, 1968

See : Koehler, 1907 : 333 (as *Ophiothrix galathea* [part]) ; H. L. Clark, 1932 : 204 (as *Ophiothrix longipeda* [part]) ; A. M. Clark & Rowe, 1971 : 114, fig. 37p (as *Macrophiothrix koehleri*).

Three Is (reef flat) – 2 ; Three Is (3.11) – 1.

In H. L. Clark's key to the species of *Macrophiothrix* (1946 : 218) this species runs down to the vicinity of *M. spinifera* and *M. scotia* (EE) because of the presence of spinelets on its oral shields, whereas its arm structure agrees far better with that of *M. belli*, the dorsal arm plates having sharp latero-distal angles and the longer arm spines smooth shafts and clavate tips.

Previous records : Probably Koehler's specimen from Torres Strait as well as H. L. Clark's Barrier Reef Expedition one from Low Isles are conspecific with *M. koehleri*.

Macrophiothrix lorioli A. M. Clark, 1968

See : A. M. Clark & Rowe, 1971 : 115, fig. 37 m.

Mid Reef (reef flat) – 1.

This specimen provides a new record for Australian waters. The species was previously known from the South China Sea, the Solomon Islands and the Tonga Islands.

In H. L. Clark's 1946 key, *M. lorioli* runs down to the vicinity of *M. callizona*, *M. calyptaspis* and *M. michaelsoni* (GG) because of the unarmed oral shields and non-trapezoidal dorsal arm plates, these being fan-shaped with more or less distinct lateral angles. *M. callizona* differs in having elliptical dorsal arm plates and the distal side of the ventral arm plates concave rather than convex. *M. calyptaspis* has the arms relatively short, less than ten times the disc diameter rather than 14–19 times in *M. lorioli* (17.5 times in this specimen), while *M. michaelsoni* from the west coast of Australia (as opposed to the north-west) has the radial shields more or less bare rather than covered with trifid stumps.

Macrophiothrix megapoma H. L. Clark, 1938

See : H. L. Clark, 1946 : 219.

DI6 – 1.

***Macrophiothrix* sp. aff. *M. longipeda* (Lamarck, 1816)**

See : H. L. Clark, 1946 : 221.

D21 - 1.

This specimen agrees in all respects with *M. longipeda* except that it has the lowermost arm spine hook-shaped with only one or two accessory spines within the main hook, rather than comb-like with multiple accessory spines. There are also only up to six arm spines (d.d. is 15 mm), an unusually small number for *M. longipeda*.

***Ophiomaza cacaotica* Lyman, 1871**

See : H. L. Clark, 1946 : 234.

D7 - 1 (on crinoid *Comatula rotalaria*).

H. L. Clark (1921) records this commensal (or parasitic) ophiuroid from *Comatula purpurea* and *Comanthus annulatus* (i.e. *Comanthus parvicirrus*). Other specimens in the British Museum collections from Queensland were from *Comatula solaris*, *Comantheria perplexa* and *Zygometa microdiscus*.

***Ophiothela danae* Verrill, 1869**

See : H. L. Clark, 1946 : 229 (as *Ophiothela hadra*) ; A. M. Clark & Rowe, 1971 : 116, pl. 14, fig. 5.

South-west of Long Reef at 15°05.2'S : 145°33.0'E (Grab st. 314A), 31 m depth - innumerable specimens on a gorgonian [5].

The arm length in these specimens appears to be 3.5-5.0 times the d.d., their colour in alcohol is blue on white (the gorgonian contrasts in vermilion but the match may have been better in life) and morphologically also there is no reason why they should not be referred to *O. danae*, with which A. M. Clark provisionally synonymized *Ophiothela hadra* in 1971. Although H. L. Clark (1915) originally distinguished *O. hadra* by the arms being only about twice the d.d., in 1946 he amended this to 'hardly' four times the d.d. It is possible that relative arm length may be correlated with the nature of the host, the types of *O. hadra* being from a sponge where shorter arms may be at an advantage. This remains to be seen from field studies, when the extent of correlation between ophiuroid and the colour of the host can also be determined, following from Japanese work on these lines.

***Ophiothrix* (*Ophiothrix*) *foveolata* Marktanner-Turneretscher, 1887**

See : A. M. Clark & Rowe, 1971 : 110, pl. 15, fig. 3.

D28 - 2 ; D51 - 3.

These records represent an extension of range to Australia. The species was previously known from the Aru and Kei Islands, the Sunda Islands and Sulu Archipelago.

Because of the completely bare radial shields and arms of moderate length, *O. foveolata* runs down to *Placophiothrix* s.l. in H. L. Clark's key to the Ophiotrichidae (1946 : 213). The very pretty colour pattern with the radial shields and distal ends of the arm segments (ventrally as well as dorsally) outlined by narrow bands (dark-red in preserved specimens) serves to distinguish it from the species which H. L. Clark included in *Ophiotrix* and *Placophiothrix* while the narrowly contiguous dorsal arm plates exclude it from *Placophiothrix*. The disc armament is relatively reduced dorsally with only a few scattered spinelets.

Four of these specimens have d.d. c. 6 mm and the arm length 5.0–6.7 times as much, while the fifth at d.d. 4 mm has arms 30 mm long, a ratio of 1 : 7.5.

***Ophiotrix (Acanthophiothrix) armata* Koehler, 1905**

See : H. L. Clark, 1932 : 205 (part, st. 25) (as *Ophiotrix stelligera*) ; A. M. Clark & Rowe, 1971 : 84, 90, 111 (as *Ophiotrix (Acanthophiothrix) armata*).

South-east of Long Reef at 15°04.6'S : 145°37.2'E (Grab st. 315A) at 31 m depth – 2 (on coral *Seriatopora*) ; D45 – 1.

Previous record : Papuan Pass (1 specimen) (H. L. Clark, 1932).

Since H. L. Clark (1932) did not distinguish the small Barrier Reef Expedition specimen from *Ophiotrix stelligera* (i.e. *O. ciliaris*), *Ophiotrix armata* is not included in his keys of 1946. It would fall within *Placophiothrix* in his wide sense, because of the conspicuous, mostly bare radial shields. In the *Placophiothrix* key (1946 : 223) it runs down to EE, *P. elegans* (with a single longitudinal dark line on each arm) and *P. trilineata*, said to have three dark lines separated by two light ones. However, this last observation is surely a mistake since other descriptions of *trilineata*, which A. M. Clark has referred back to *Ophiotrix* s.s., give three *light* lines and two dark ones between them, the limits of the outer light ones sometimes irregular or ill-defined.

All four specimens from the Great Barrier Reef are small with slender arms and needle-like spines, the arms being marked with two dark lines without a background of lighter colour.

***Ophiotrix (Acanthophiothrix) proteus* Koehler, 1905**

See : A. M. Clark & Rowe, 1971 : 111, pl. 15, fig. 5.

K6 – 1.

This record provides an extension of range to Australia. The species has previously been recorded in the Pacific from the South China Sea, the Sunda Islands, Kei Islands and New Caledonia.

The single specimen belongs to the colour form of *O. proteus* which has the double dark lines on each arm green rather than purple, though the radial shields and central disc plates are still pinkish after preservation in alcohol ; the keel of the dorsal arm plates between the green lines is white. The longest arm spine is five to six times the segment length.

Like the species above, *O. (Acanthophiothrix) proteus* is likely to run down to section EE of H. L. Clark's 1946 key to the species of *Placophiothrix*. Again it is a much more slender species than *trilineata*.

***Ophiothrix (Acanthophiothrix) purpurea* von Martens, 1867**

See : A. M. Clark & Rowe, 1971 : 112, fig. 35d, pl. 15, figs 4, 11.
D16 – 1.

This record provides an extension of range to Australian waters. The species has previously been recorded through most of the Indo-West Pacific, including the Banda Sea, New Hebrides and Solomon Islands in the neighbourhood of Australia.

The specimen is small with d.d. only *c.* 1.5 mm but has the distinctive narrow dark line on each arm and very slender form. Again it runs down to section EE of H. L. Clark's *Placophiothrix* key but differs from *P. elegans*, which A. M. Clark has referred back to *Ophiothrix* s.s., recorded from Disaster Bay, N.S.W., in the narrow hexagonal rather than broad rhombic dorsal arm plates and more needle-like armament.

***Ophiothrix (Keystonea) propinqua* Lyman, 1861**

See : H. L. Clark, 1946 : 232 (as *Ophiotrichoides propinqua*) ; A. M. Clark & Rowe, 1971 : 107, pl. 15, fig. 7 (as *Ophiothrix (Keystonea) propinqua*).
K4 – 1.

Previous record : Murray Is (H. L. Clark, 1946).

***Ophiothrix (Theophris) pusilla* Lyman, 1874**

See : A. M. Clark & Rowe, 1971 : 107, fig. 35c, pl. 15, fig. 8.
D6 – 1 ; D36 – 1 ; K3 – 1.

These records provide an extension of range to Australian waters. The species has previously been recorded from the South China Sea, Philippines, Sunda and Kei Islands.

The three specimens have d.d. 2.6–3.5 mm and d.d. : a.l. 1 : 2.3–3.7, the relative length increasing with size. The colour in alcohol is pale with a bluish tinge and faint blue irregular bands on the arms.

This is a small but distinctive species with its thick, elongate, oval dorsal arm plates, much narrower than long, relatively short arm spines not exceeding twice the segment length and complete covering of the disc including the radial shields with trifid stumps. The structure and shortness of the arms serve to distinguish it from all the species included in H. L. Clark's key for *Ophiothrix* (1946 : 214).

OPHIOCOMIDAE

***Ophiarthrum elegans* Peters, 1851**

See : H. L. Clark, 1946 : 252.

Mid Reef (reef flat) – 8[2] ; Three Is (reef flat) – 2 ; K4 – 1.

Ophiocoma dentata Müller & Troschel, 1842

See: H. L. Clark, 1946 : 246 (as *Ophiocoma insularis* var. *variegata*) ; Endean, 1953 : 55 ; 1956 : 126 (both as *O. insularia* var. *variegata*) ; A. M. Clark & Rowe, 1971 : 119 (as *O. dentata*).

Mid Reef (reef flat) – 8[1] ; Lark Passage (reef flat) – 2.

Ophiocoma erinaceus Müller & Troschel, 1842

See: H. L. Clark, 1946 : 244.

Turtle IV I. (reef flat) – 1.

Ophiocoma scolopendrina (Lamarck, 1816)

See: H. L. Clark, 1946 : 243.

Three Is (reef flat) – 7[1] ; Lark Passage (reef flat) – 1.

Ophiocomella sexradia (Duncan, 1887)

See: H. L. Clark, 1946 : 206 (as *Amphiacantha sexradia*) and 247 (as *Ophiocoma parva*) ; A. M. Clark & Rowe, 1971 : 118, fig. 38c–f (as *Ophiocomella sexradia*).

Turtle I I. (reef flat) – 1.

Previous records : Mer, Murray Is [also Lord Howe I.] (H. L. Clark, 1946).

OPHIONEREIDAE***Ophionereis dubia*** (Müller & Troschel, 1842)

See: H. L. Clark, 1946 : 240 (as *Ophionereis stigma* and *O. dubia*).

D3 – 1 ; D6 – [1] ; D19 – 1.

As noted in 1953 (*Proc. zool. Soc. Lond.* **123** : 82) although H. L. Clark's supposition that the 'Alert' specimens from Torres Strait named *Ophionereis dubia* by Bell are in fact *O. semoni* (Döderlein) is largely correct, two of them do have the disc scaling, oral shields and proximal ventral plates unobscured by skin and the arm spines relatively long, thereby justifying the inclusion of *O. dubia* in the Australian fauna even if it were not for the inclusion of the north-western Australian *Ophionereis stigma* H. L. Clark in the synonymy.

The present records extend the range south from Torres Strait.

Ophionereis porrecta Lyman, 1860

See: H. L. Clark, 1946 : 238.

K4 – 1.

Previous record : Murray Is (H. L. Clark, 1921).

Ophionereis semoni (Döderlein, 1896)

See : H. L. Clark, 1946 : 240.

D47 - 1 ; K3 - 4[2].

Previous records : Lindeman I., near Mackay (H. L. Clark, 1938) ; east of Snake Reef (H. L. Clark, 1932) ; Low Is (Endean, 1956).

OPHIODERMATIDAE***Ophiarachna incrassata*** (Lamarck, 1816)

See : H. L. Clark, 1946 : 253.

Watson I. (reef flat) - 1 ; Mid Reef (reef flat) - 2.

Ophiarachnella gorgonia (Müller & Troschel, 1842)

See : H. L. Clark, 1946 : 260.

Mid Reef - 4[1].

Ophiarachnella infernalis (Müller & Troschel, 1842)

See : H. L. Clark, 1946 : 262.

D27 - 1 ; D51 - 1.

Ophiochaeta hirsuta Lütken, 1869

See : A. M. Clark & Rowe, 1971 : 127, fig. 44a, b.

D6 - 1.

This record provides an extension of range to Australian waters. The species has previously been recorded from Fiji and the Gilbert Islands and there are specimens in the British Museum collections from Aldabra (Indian Ocean) and Tetel (or Gaskell) Island in the Solomon Islands (collected by Dr H. G. Ververs in 1965).

Though small (d.d. 4 mm) the specimen shows the mixture of extremely fine spinelets and indented granules on the disc and the spiniform rather than granuliform armament of the oral plates, which serve to distinguish *Ophiochaeta hirsuta* from all the ophiodermatids included in H. L. Clark's key (1946 : 252). The arm spines are short and appressed and the oral shields are bare. Unusually in this specimen the radial shields are also bare but this may be a juvenile character. The colour in alcohol consists of a light brown central area on the disc bordered with dark brown and then a white peripheral area ; ventrally the disc and arm bases are white but the rest of the arms are banded with brown on both sides.

Ophiochasma stellatum (Ljungman, 1867)

See : H. L. Clark, 1946 : 259.

D21 - 1 ; D26 - 3 ; D27 - [1] ; K3 - 2[1].

Ophiopeza spinosa (Ljungman, 1867)

See : H. L. Clark, 1946 : 258 (as *Ophiopozella spinosa*) ; A. M. Clark & Rowe, 1971 : 127, fig. 44e (as *Ophiopeza spinosa*).

K5 - 1 ; K6 - 1.

Previous records : Torres Strait ; Murray Is (H. L. Clark, 1921).

Ophiopsammus yoldii (Lütken, 1856)

See : H. L. Clark, 1946 : 257 (as *Pectinura yoldii*) ; A. M. Clark & Rowe, 1971 : 127, pl. 21, figs 7, 8 (as *Ophiopsammus yoldii*).

K3 - 11[2].

***Ophiodermatid* sp. juv.**

K3 - 1.

OPHIURIDAE***Ophiolepis superba*** H. L. Clark, 1915

See : H. L. Clark, 1946 : 272.

Two Is (reef flat) - 3.

Ophiura kinbergi (Ljungman, 1867)

See : H. L. Clark, 1946 : 270.

D21 - 1 ; D23 - 1 ; D29 - 2[1] ; D31 - 5.

Previous record : Murray Is (Endean, 1957).

Class ECHINOIDEA**CIDARIDAE*****Prionocidaris bispinosa*** (Lamarck, 1816)

See : H. L. Clark, 1946 : 286.

D17 - 3[1].

DIADEMATIDAE***Diadema setosum*** (Leske, 1778)

See : H. L. Clark, 1946 : 297 (as *Centrechinus setosus*) ; Endean, 1956 : 127 (as *Diadema setosum*).

Two Is (reef flat) - 1 ; Three Is (reef flat) - S.

TEMNOPLEURIDAE

Mespilia globulus (Linnaeus, 1758)

See : H. L. Clark, 1946 : 315.

Turtle I I. (reef flat) - 1 ; D50 - 5[1] ; K6 - 1.

Previous records : Port Denison (Mortensen, 1943) ; Trinity Bay (off Cairns) (Tenison-Woods, 1880b) ; Low Is ; Hardy Reef ; Heron I. (Endean, 1961).

Temnopleurus alexandri (Bell, 1884)

See : H. L. Clark, 1946 : 311 (as *Salmacis virgulata* var. *alexandri*) ; Endean, 1956 : 128 (as *Temnopleurus alexandri*).

D1 - 1.

Temnotrema phoenissa H. L. Clark, 1926

See : H. L. Clark, 1946 : 314.

D50 - 1.

This small echinoid, h.d. (horizontal diameter) 15 mm, v.d. 10 mm, is still very distinctively coloured in alcohol. The apical system is greenish, the test aborally dark purplish-red, darker in the interambulacral areas, the aboral spines red with white tips and the primary ones also with white bases ; orally the test is white and the spines pale green. This combination of colours agrees not only with that of the holotype and only recorded specimen of *Temnotrema phoenissa* from Ellison Reef (h.d. only 6.5 mm) but also with *Temnotrema pulchellum* (Mortensen), known from the Philippines to the Kei Islands. Mortensen (1943 : 268) has already suggested that the two nominal species may prove to be conspecific. Without material of *T. pulchellum* to hand this problem cannot be resolved.

Temnopleurid sp.

D4 - 1 ; D39 - 3.

TOXOPNEUSTIDAE

Gymnechinus epistichus H. L. Clark, 1912

See : H. L. Clark, 1946 : 326.

D21 - 1.

Tripneustes gratilla (Linnaeus, 1758)

See : H. L. Clark, 1946 : 326.

Three Is (reef flat) - 1.

PARASALENIIDAE

Parasalenia sp.

K4 - 1 (test only and therefore not positively identifiable).

ECHINOMETRIDAE

Echinometra mathaei (de Blainville, 1825)

See : H. L. Clark, 1946 : 332.

Three Is (reef flat) - 2.

ECHINONEIDAE

Echinoneus abnormalis de Lorient, 1883

See : A. M. Clark & Rowe, 1971 : 158.

K4 - 1.

This record provides an extension of range to Australia. The specimen differs from *Echinoneus cyclostomus* Leske, 1778, known from Low Isles and Heron Island (Endean, 1956) and from Lord Howe Island (H. L. Clark, 1938), in having the spine tubercles perforated and in lacking glassy knobs on the test. *E. abnormalis* has previously been recorded from Mauritius (the type locality), the Kei Islands, Rotuma in the Ellice Islands, Palmyra Island and the Hawaiian Islands; there is also a specimen in the British Museum collections from Aldabra. Since the species is sympatric in most, if not all, of these localities with the much more common *E. cyclostomus*, it is possible that *E. abnormalis* may have gone unrecognized in other samples.

FIBULARIIDAE

Fibularia ovulum Lamarck, 1816

See : A. M. Clark & Rowe, 1971 : 161, 167.

K7 - 1.

This record represents an extension of range to Australia. The species has previously been recorded from most parts of the tropical Indo-West Pacific except from the more remote Pacific islands.

Although Mortensen (1948) reckons that most of H. L. Clark's records of *Fibularia craniolaris* (Leske, 1778) are conspecific with *Fibularia ovulum*, he makes an exception of the Australian ones, referring them instead to *Fibularia oblonga* Gray, 1851, which he recorded from 'South, West and North Australia', without precise localities (1948 : 223). However, in H. L. Clark's key to the Australian species of *Fibularia* (1946 : 347) the present specimen does tend to run down to *F. craniolaris* on account of its high ovoid test (length : height 4.5 : 3.5 mm) and the rounded

pores forming distinct petals on the aboral side (though they are not appreciably smaller than the genital pores). In these same characters it also agrees with *F. oblonga*, recorded by Endean (1961 : 294) from Caloundra, southern Queensland, but in intact specimens like this one, as opposed to dead tests, there are important differences in the plating of the peristome and periproct. In *F. ovulum* the peristomial membrane is devoid of plates and the periproct has five triangular plates, as this specimen shows, whereas *F. oblonga* has multiple small irregular plates in both peristome and periproct. However, dead tests of *F. ovulum* should be recognizable as having the round or quadrangular periproct as broad as or broader than long, whereas in *F. oblonga* it is normally elongate oval.

According to H. L. Clark the common *Fibularia* in northern Australia is *F. volva* Agassiz & Desor, 1847, which should be distinguishable from both *F. ovulum* and *F. oblonga* by the relatively low test (length : height c. 2 : 1) with more or less tapering ends.

Fibulariid sp.

D37 - 2 (tests only).

LAGANIDAE

***Laganum decagonale* (de Blainville, 1827)**

See : A. M. Clark & Rowe, 1971 : 162.

D41 - 1.

Previous records : Torres Strait (Agassiz, 1881) ; Bowen (Mortensen, 1948).

This species was excluded from the Australian fauna by H. L. Clark (1946) although in 1925 (p. 156) he cited a *Challenger* specimen of *Laganum decagonale* from Torres Strait, following Agassiz. There are now a total of eight *Challenger* laganids from Torres Strait in the British Museum collections, some acquired since 1925. Although they show considerable variation in the number and development of the genital pores and the shape of the test, several of them agree with Mortensen's description of *L. decagonale* (1948 : 331) in having five genital pores and an S-shaped groove for the madreporic pores on the apical system, both characters distinguishing them from *Peronella*. However, the extent of the variation throws some doubt on the generic weight of these characters. The remaining *Challenger* specimens bridge the gap with, and may even run down to, *Peronella lesueurii* (Valenciennes, 1841) to which H. L. Clark (1946 : 346) referred them.

***Laganum depressum* Lesson in L. Agassiz, 1841**

See : H. L. Clark, 1946 : 343 (*Laganum depressum*) and 344 (*Laganum dyscritum*) ; Endean, 1956 : 129, 134 (*L. depressum*).

Low Is : (L5) - 5 ; (L6) - 4 ; D17 - 1 ; D27 - 1 ; D30 - [2] ; D31 - 1 ; D33 - 1 ; D41 - 1 ; D46 - 1.

This species is very common in muddy sand close to the Anchorage at Low Isles, as also noted by Endean (1956) who agreed with Mortensen (1948) that *Laganum dyscritum* H. L. Clark, 1932, of which Low Isles in the type locality, is synonymous with *Laganum depressum*. H. L. Clark had acknowledged the likelihood of confusion between the two but considered that those he called *L. dyscritum* have significantly broader tests, more posteriorly situated periprocts and relatively larger petaloid areas, besides having more elongated spinelets and a purplish brown coloration, rather than the yellowish-khaki usual in *L. depressum*. Mortensen attributed the colour difference to the type material of *L. dyscritum* possibly having been preserved together with comatulids and it is certainly true that most Queensland comatulids are very liable to release copious amounts of purple pigment in alcohol. None of the laganids collected at Low Isles by Gibbs are at all purple. The morphological differences Mortensen discounted as being within the range of variation of *L. depressum*. His conclusion is supported by a series of measurements made on the present collection together with the material from the Great Barrier Reef Expedition which H. L. Clark referred to both *L. depressum* and *L. dyscritum* as well as specimens of *L. depressum* from various other parts of its extensive Indo-Pacific range.

Although H. L. Clark recorded four specimens of *Laganum* from Low Isles as *L. depressum*, these are all large spineless tests, length 60 mm or more, and do not compare in size with the numerous specimens from Low Isles which he referred to *L. dyscritum* where length is 28–42 mm. The three Great Barrier Reef Expedition specimens from st. XXIV (NE of Pasco Reef) with length 32–45 mm are unfortunately not in the British Museum collections and must be either at Harvard or the Australian Museum. H. L. Clark's values for test breadth of *L. depressum* of 0.80–0.85 (or 80–85%) of length and c. 20% for distance of the periproct from the posterior edge of the test appear to have been taken from the two tests from the Anchorage area, now measured as 71 and 65 mm in length with breadths 79 and 89% and periproctal distance 19 and 18%. However, 30 specimens of *L. depressum* with test length c. 25–40 mm from various localities show a much greater breadth range, from 83–93% with a mean of 89%. This compares with a range of 80–94% and again a mean of 89% for 30 of the specimens which H. L. Clark named *L. dyscritum*, suggesting that his figure of 90–95% was biased and probably derived from only a few specimens. The mean periproctal distance also practically coincides when these two series are compared, nor is there a significant difference in the relative length of the petaloid area.

Laganid sp. juv.

K3 – 1; K8 – 1.

***Peronella lesueuri* (Valenciennes in L. Agassiz, 1841)**

See: H. L. Clark, 1946: 346.

K8 – 1.

Peronella orbicularis (Leske, 1778)

See : H. L. Clark, 1946 : 346.

D2 - 1 ; D7 - 2 ; D14 - 1 ; D16 - 1 ; D19 - 2 ; D36 - 1 ; D48 - 1 ; D49 - 1 ;
D52 - [2] ; K2 - 2 ; K3 - 1.

***Peronella* sp. juv.**

D1 - 1.

SPATANGIDAE***Maretia planulata*** (Lamarck, 1816)

See : H. L. Clark, 1946 : 380 (as *Maretia ovata*) [non *Spatangus ovatus* Leske, 1778] ;
Endean, 1956 : 129 (as *Maretia planulata*).

Low Is (L5) - 15 ; Low Is (Anchorage at 3 m depth) - 2 ; D23 - 1 ; D26 - [1] ;
D29 - 4 ; K1 - 6 ; K3 - 8[6].

Like *Laganum depressum* this species is common in muddy sand close to the Anchorage on Low Isles. During the period of exposure on day-time spring tides it often comes to the surface of the sand. This habit has also been noted in *Lovenia elongata* in the Red Sea and elsewhere.

LOVENIIDAE***Lovenia elongata*** (Gray, 1845)

See : H. L. Clark, 1946 : 381.

K7 - 1.

SCHIZASTERIDAE***Schizaster lacunosus*** (Linnaeus, 1758)

See : H. L. Clark, 1946 : 368.

Low Is (L2) - 1. South of Arlington Reef at 16°42.5'S : 145°57.0'E (Grab ARL 16)
at 51 m depth - 1. [Both from muddy sand.]

Previous records : Torres Strait ; Turtle Is (H. L. Clark, 1946).

BRISSIDAE***Brissus latecarinatus*** (Leske, 1778) (Fig. 3b)

See : H. L. Clark, 1946 : 375.

Pelican I. (strand line) - 4 (tests only) ; D19 - 1.

One of the four specimens from Pelican Island agrees in some ways more with *Brissus agassizi* Döderlein, 1885, having the posterior end of the test vertically truncated, the posterior interambulacrum being only slightly carinate aborally and

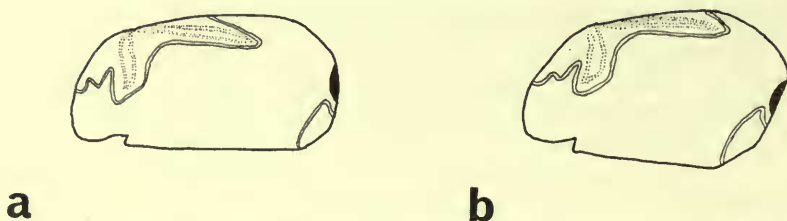


FIG. 3. Profiles of (a) *Brissus agassizi* Döderlein and (b) *B. latecarinatus*.

not prolonged backwards to overhang the periproct and conceal it from dorsal view (Fig. 3a), in contrast to *B. latecarinatus* (Fig. 3b). Endean (1956 : 129) records as '*Brissus* (? *latecarinatus*)' a dead test from Heron Island which approximates to some extent with this specimen, lacking the overhang above the periproct, though it does have the posterior end of the test 'obliquely truncate as in typical *B. latecarinatus*'. In the absence of pedicellariae from this specimen it is impossible to determine if it is specifically distinct, the globiferous ones of *B. agassizi* being unusual in terminating in a slit bordered with long narrow teeth rather than a rounded opening with numerous small teeth, as in *B. latecarinatus*.

***Metalia spatagus* (Linnaeus, 1758)**

See : H. L. Clark, 1946 : 372.

Low Is (L6) - 1.

Previous records : Torres Strait ; Low Is (H. L. Clark, 1946).

***Metalia sternalis* (Lamarck, 1816)**

See : H. L. Clark, 1946 : 372.

Low Is : (L6) - 1 ; (L7) - 1 ; D29 - [1].

These three specimens and the single *Metalia spatagus* were all living in muddy sand.

Previous record : Low Is (H. L. Clark, 1946 ; Endean, 1957).

Class *HOLOTHURIOIDEA*

HOLOTHURIIDAE

***Actinopyga ?miliaris* (Quoy & Gaimard, 1833)**

Bird I. (sand flat) - 1 ; Three Is (reef flat) - 1 ; Lark Passage (reef flat) - S.

The two specimens collected both have extraordinarily few spicules and their provisional identification as *A. miliaris* is mainly because of the uniformly dark colour.

***Bohadschia argus* Jaeger, 1833**

See : H. L. Clark, 1946 : 425 (as *Holothuria argus*) ; A. M. Clark & Rowe, 1971 : 176 (as *Bohadschia argus*).

Three Is (reef flat) - 1.

***Bohadschia bivittata* (Mitsukuri, 1912)**

See : A. M. Clark & Rowe, 1971 : 194.

Two Is (2.4) - 1.

This record provides an extension of range to Australian waters. The species has previously been recorded from southern Japan to the Philippines, Caroline Islands, Fiji, Samoa and the Bismarck Archipelago, north of New Guinea.

The single large individual was found almost buried below the surface of muddy sand. After preservation in alcohol for about a year it still shows the very distinctive colour pattern of *Bohadschia bivittata* with two broad dark brown transverse bands across the otherwise pale yellow upper side. After contraction in preservation the specimen measures 170 mm in length. The more anterior brown band is c. 30 mm wide but is not sharply delimited anteriorly, the area up to and around the ring of 20 tentacles being brownish. The median pale 'saddle' is c. 25 mm wide and the posterior brown band c. 40 mm wide, not sharply delimited posteriorly. The under-side is uniformly pale.

H. L. Clark did not distinguish *Bohadschia* from *Holothuria*. In his key to *Holothuria* (1946 : 422) this species, with its rosettes in the body wall, runs down to section C, which includes *Bohadschia argus* marked with spots and *B. marmorata* with irregular brown blotches on the upper side.

***Bohadschia marmorata* Jaeger, 1833**

See : H. L. Clark, 1946 : 426 (as *Holothuria marmorata*) ; A. M. Clark & Rowe, 1971 : 176 (as *Bohadschia marmorata*).

Low Is (L3) - 1 ; Two Is (2.4) - 1.

***Holothuria (Acanthotrapeza) coluber* Semper, 1868**

See : H. L. Clark, 1946 : 428.

Three Is (reef flat) - 1.

***Holothuria (Cystipus) rigida* (Selenka, 1867)**

See : H. L. Clark, 1946 : 432.

Two Is (reef flat) - 1.

Previous records : Murray Is ; Green I. (H. L. Clark, 1946 ; Endean, 1957).

***Holothuria (Halodeima) atra* Jaeger, 1833**

See : H. L. Clark, 1946 : 427.

Mid Reef - S ; Low Is (L3) - 3 ; Three Is (reef flat) - 4[2] ; Three Is (3.5) - 1 ;
Lark Passage (reef flat) - 1.

***Holothuria (Lessonothuria) pardalis* Selenka, 1867**

See : H. L. Clark, 1946 : 437.

Three Is (reef flat) - 2.

***Holothuria (Mertensiothuria) leucospilota* (Brandt, 1835)**

See : H. L. Clark, 1946 : 438.

Mid Reef - S ; Three Is (reef flat) - 4[1].

***Holothuria (Mertensiothuria) ?leucospilota* (Brandt)**

See : H. L. Clark, 1921 : 179.

Low Is (L5) - [1] ; Three Is (3.5) - 1.

When collected these two specimens were dark brown, as usual in *H. leucospilota* but after preservation in alcohol they turned quite black, whereas the specimens positively identified as *H. leucospilota* are purplish-brown. In addition, these two were found buried on a sand flat, not on a reef flat where *H. leucospilota* is usually so conspicuous stretching out from under stones.

However, H. L. Clark (1921) notes that older individuals of this species are much more black in colour ; though very contracted now, the two specimens were almost certainly distinctly larger than the rest in life. Their body walls, spicules and calcareous ring agree very well.

***Holothuria (Metriatyla) scabra* Jaeger, 1833**

See : H. L. Clark, 1946 : 430.

Pipon Is (sand flat) - 6[1] ; Bird I. (sand flat) - 3.

Holothuria (Theelothuria) sp. juv.

D32 - 1.

This small specimen has the tack-like spicules characteristic of the subgenus *Theelothuria* but cannot be identified to species.

***Holothuria (Thymiosycia) arenicola* Semper, 1868 (Pl. 1, fig. 4)**

See : H. L. Clark, 1946 : 438.

Low Is (L4) - 5 ; Three Is (3.2 & 3.5) - 2 ; Two Is (2.2) - [1].

This species is one of the most conspicuous members of the infauna of the sand flats, burrowing to a depth of about 25 cm. One specimen harboured the commensal fish *Carapus homei* Richardson (see Mukerji, 1932; Jangoux, 1974).

Even when preserved in alcohol, these specimens show a conspicuously abrupt change in colour at about 10–20 mm from the anus, from the yellowish-brown with lines of small dark blotches, usually described for this species, to pure white, though after two years this is much less distinct than in the photograph from life shown in Plate 1. Among the 55 specimens of *H. arenicola* preserved in the British Museum collections, two show a distinctly lighter posterior end; one was collected by Gibbs in the Solomon Islands in 1965 and the other, from the 'Java Sea', was received as long ago as 1889. As far as we can ascertain, this abrupt colour change to white posteriorly has not been recorded in the literature.

***Holothuria (Thymiosycia) impatiens* (Forskaal, 1775)**

See : H. L. Clark, 1946 : 434.

Three Is (reef flat) – 2.

***Labidodemas semperianum* Selenka, 1867**

See : H. L. Clark, 1946 : 421.

Low Is (L3) – 2.

Previous records : Murray Is ; Capricorn Group (H. L. Clark, 1946).

STICHOPODIDAE

***Stichopus chloronotus* Brandt, 1835**

See : H. L. Clark, 1946 : 417.

Mid Reef (reef flat) – S ; Low Is (L3) – 1 ; Three Is (reef flat) – S ; Lark Passage (reef flat) – S ; Two Is (reef flat) – S.

***Stichopus horrens* Selenka, 1867**

See : H. L. Clark, 1946 : 418.

Three Is (reef flat) – 1.

***Stichopus variegatus* Semper, 1868**

See : H. L. Clark, 1946 : 418.

Three Is (reef flat) – 1 ; D17 – 1 ; K4 – 1.

CUCUMARIIDAE

***Havelockia* sp. juv.**

D3 – 1 ; D21 – 1.

It is likely that this species would have been included in *Thyone* by H. L. Clark.

Pentacta australis (Ludwig, 1875)

See : H. L. Clark, 1946 : 392.

D21 - 2.

Pentacta cucumis (Semper, 1868)

See : H. L. Clark, 1946 : 393.

D7 - 1.

Previous records : Torres Strait (H. L. Clark, 1946) ; west of N Direction I. (H. L. Clark, 1932) ; Coppersmith I. (south of Whitsunday Group) (Endean, 1956).

Thyone papuensis Théel, 1886

See : H. L. Clark, 1946 : 399.

K8 - 1.

PHYLLOPHORIDAE***Afrocucumis africana*** (Semper, 1868)

See : H. L. Clark, 1946 : 404 (as *Discucumaria africana*) ; Endean, 1956 : 130 (as *Discucumaria africana*) ; A. M. Clark & Rowe, 1971 : 182 (as *Afrocucumis africana*).

Three Is (reef flat) - [2] Three Is (3.7) - 3 ; Noble I. (reef flat) - 1.

An additional specimen from the Three Islands reef flat lacks spicules in the body wall and cannot be positively identified.

Actinocucumis typicus Ludwig, 1874

See : H. L. Clark, 1946 : 403.

D47 - 1.

Phyllophorus (Phyllothuria) cebuensis (Semper, 1868)

See : H. L. Clark, 1946 : 409.

D48 - [1].

We are indebted to Dr F. W. E. Rowe of the Australian Museum for identifying this very small specimen.

This record provides an extension of range to Queensland waters from Western Australia, H. L. Clark (1938) having named as *P. cebuensis* a small specimen from Dongarra, near Geraldton, though expressing a little doubt. Previous records are from the Philippines (the type locality) and Indonesia.

SYNAPTIDAE***Leptosynapta latipatina*** H. L. Clark, 1921

See : H. L. Clark, 1946 : 454 (*Leptosynapta parvipatina* [lapsus]).

Low Is (L1) - 1.

The single specimen was found among *Mesochaetopterus* tubes in muddy sand. The species was previously known only from the incomplete holotype, taken at Friday Island, Torres Strait (H. L. Clark, 1921).

Opheodesoma grisea (Semper, 1868)

See : H. L. Clark, 1946 : 449.

Low Is (*Tripneustes* spit) – 1.

Rynkatorpa sp. nov. (to be described by F. W. E. Rowe; see p. 108)

D33 – 2 pieces [$\frac{1}{2}$] (very small).

Synaptula recta (Semper, 1868)

See : H. L. Clark, 1946 : 453 (as *Chondrocloea recta*) ; A. M. Clark & Rowe, 1971 : 188 (as *Synaptula recta*).

Beesley I. (sand flat) – 1.

CHIRIDOTIDAE

Chiridota rigida (Semper, 1868)

See : H. L. Clark, 1946 : 457.

Low Is : (L3) – 3 ; (L7) – [1].

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TABLE 4

List of some associates of these echinoderms, collected simultaneously

| Host | Associate | |
|--|---------------------------------------|------------|
| CRINOIDEA | | |
| <i>Comantheria briareus</i> | <i>Paradyte crinoidicola</i> (Potts) | Polychaete |
| | <i>Myzostomum</i> sp. | Myzostome |
| <i>Comantheria</i> or <i>Comanthus</i> sp. | <i>Myzostomum</i> sp. | Myzostome |
| <i>Comanthina schlegeli</i> | <i>Paradyte crinoidicola</i> | Polychaete |
| | <i>Myzostomum</i> sp. | Myzostome |
| <i>Comanthus bennetti</i> | <i>Paradyte crinoidicola</i> | Polychaete |
| | <i>Galathea elegans</i> Adams & White | Decapod |

TABLE 4 (cont.)

| HOST | ASSOCIATE | |
|---------------------------------|--|------------|
| <i>Comanthus parvicirrus</i> | <i>Myzostomum polycyclus</i> Atkins | Myzostome |
| | <i>Myzostomum</i> sp. | Myzostome |
| <i>Comanthus samoanus</i> | <i>Paradyte crinoidicola</i> | Polychaete |
| | <i>Myzostomum</i> sp. | Myzostome |
| | <i>Galathea australiensis</i> Stimpson | Decapod |
| <i>Comatella stelligera</i> | <i>Myzostomum</i> sp. | Myzostome |
| | Eulimid sp. | Gastropod |
| <i>Comatula rotalaria</i> | <i>Ophiomaza cacaotica</i> Lyman | Ophiuroid |
| <i>Himerometra robustipinna</i> | <i>Paradyte crinoidicola</i> | Polychaete |
| | <i>Myzostomum costatum</i> Leuckart | Myzostome |
| | <i>Myzostomum crosslandi</i> Boulenger | Myzostome |
| | <i>Galathea elegans</i> | Decapod |
| <i>Colobometra perspinosa</i> | <i>Paradyte crinoidicola</i> | Polychaete |
| <i>Tropiometra afra</i> | <i>Paradyte crinoidicola</i> | Polychaete |
| | <i>Galathea elegans</i> | Decapod |
| ASTEROIDEA | | |
| <i>Archaster typicus</i> | <i>Ophiodromus</i> sp. | Polychaete |
| <i>Pentaceraster regulus</i> | <i>Hololepidella nigropunctata</i> (Horst) | Polychaete |
| OPHIUROIDEA | | |
| <i>Ophiarthrum elegans</i> | <i>Hololepidella nigropunctata</i> | Polychaete |
| <i>Ophiocoma dentata</i> | <i>Hololepidella nigropunctata</i> | Polychaete |
| <i>Macrophiothrix belli</i> | <i>Hololepidella nigropunctata</i> | Polychaete |
| HOLOTHURIOIDEA | | |
| <i>Actinopyga</i> sp. | <i>Gastrolepidia clavigera</i> Schmarda | Polychaete |
| <i>Bohadschia argus</i> | <i>Gastrolepidia clavigera</i> | Polychaete |
| <i>Holothuria coluber</i> | <i>Gastrolepidia clavigera</i> | Polychaete |
| <i>Holothuria atra</i> | <i>Gastrolepidia clavigera</i> | Polychaete |
| <i>Holothuria leucospilota</i> | <i>Gastrolepidia clavigera</i> | Polychaete |
| <i>Holothuria arenicola</i> | <i>Carapus homei</i> Richardson | Fish |
| <i>Stichopus chloronotus</i> | <i>Gastrolepidia clavigera</i> | Polychaete |
| <i>Chiridota rigida</i> | 'Leptonid' sp. | Bivalve |

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